

APPENDIX A.—ASSUMPTIONS AND METHODS UNDERLYING THE ACTUARIAL ESTIMATES

This appendix describes the assumptions and methods which underlie the actuarial estimates in this report. Unless specifically stated otherwise, the assumptions and methods were used for each of the four alternatives and for both the short-range and long-range periods. Some of the economic and demographic assumptions which vary by alternative are summarized in the section entitled "Actuarial Estimates." Further details about the assumptions, methods, and actuarial estimates are contained in Actuarial Studies published by the Office of the Actuary, Social Security Administration, and are available upon request.

TOTAL POPULATION

Projections were made of the population in the Social Security coverage area by age, sex, and marital status as of January 1 of each year 1989 through 2080. The projections started with an estimate of the United States population, including armed forces overseas, as of January 1, 1988, based on data from the Bureau of the Census. This population estimate was adjusted for net census undercount and increased for other U.S. citizens living abroad and for populations in the geographic areas covered by the OASDI program but not included in the U.S. population. This population was then projected using assumed rates of birth, death, marriage, and divorce and assumed levels of net immigration.

Historically, fertility rates in the U.S. have fluctuated widely. The total fertility rate is defined to be the average number of children that would be born to a woman in her lifetime if she were to experience the birthrates by age observed in, or assumed for, the selected year, and if she were to survive the entire child-bearing period. The total fertility rate decreased from 3.3 children per woman after World War I to 2.1 during the Great Depression, rose to 3.7 in 1957, and then fell to 1.7 in 1976. Since then, it has risen to a level currently estimated at 1.9.

These variations in fertility rates have resulted from changes in many factors, including social attitudes, economic conditions, and the use of birth-control methods. Future fertility rates may be expected to remain close to recent levels. The recent historical and projected trends in certain population characteristics are consistent with a continued relatively low fertility rate. These trends include the rising percentages of women who have never married, of women who are divorced, and of young women who are in the labor force. Based on consideration of these factors, ultimate total fertility rates of 2.2, 1.9, and 1.6 children per woman were selected for alternatives I, II-A and II-B, and III, respectively. For each alternative, the total fertility rate is assumed to reach its ultimate level in 2014. These ultimate values can be compared to those used by the Bureau of the Census for its latest series of population projections. Those fertility rates range from 2.2 to 1.5, with an intermediate assumption of 1.8.¹ A rate of 2.1 would ultimately result in a nearly constant population if net immigration were zero and if death rates were constant.

¹U.S. Bureau of the Census, Current Population Reports, Series P-25, No. 1018, "Projections of the Population of the United States By Age, Sex, and Race: 1988-2080," U.S. Government Printing Office, Washington, D.C., January 1989.

Historically, death rates in the U.S. have declined steadily. The age-sex-adjusted death rate—which is the crude rate that would occur in the enumerated total population as of April 1, 1980, if that population were to experience the death rates by age and sex for the selected year—declined at an average rate of 1.2 percent per year between 1900 and 1988. These reductions in death rates have resulted from many factors, including increased medical knowledge and availability of health-care services and improvements in personal health-care practices such as diet and exercise. Based on consideration of the likelihood of continued progress in these and other areas, three alternative sets of ultimate annual percentage reductions in central death rates by age, sex, and cause of death were selected for 2014 and later. The intermediate set, which is used for both alternatives II-A and II-B, is considered to be the one closest to average expectations. The average annual percentage reductions used for alternative I are smaller than those for alternatives II-A and II-B, while those used for alternative III are greater. Between 1989 and 2014, the reductions in central death rates for alternatives II-A and II-B are assumed to change gradually from the average annual reductions by age, sex, and cause of death observed between 1968 and 1987, to the ultimate annual percentage reductions by age, sex, and cause of death assumed for 2014 and later. Alternative I reductions are assumed to change gradually from 50 percent of the average annual reductions observed between 1968 and 1987, while alternative III reductions are assumed to change gradually from 150 percent of the average annual reductions observed between 1968 and 1987. The age-sex-adjusted death rate (for all causes combined) declined at an average rate of 1.6 percent per year between 1968 and 1987.

After adjustment for changes in the age-sex distribution of the population, the resulting death rates were projected to decline at an average annual rate of about 0.3 percent, 0.6 percent, and 0.9 percent between 1989 and 2064 for alternatives I, II-A and II-B, and III, respectively.

Beginning with 1990, net immigration is assumed to be 750,000, 600,000, and 450,000 persons per year for alternatives I, II-A and II-B, and III, respectively. Of these net numbers of immigrants, 450,000, 400,000, and 350,000, respectively, are assumed to be legal, and the remainders are assumed to be other-than-legal. For 1988 and 1989, the net legal immigration is assumed to be 400,000 persons per year and, consistent with the estimates of other-than-legal immigration made by the Bureau of the Census since the 1980 Census, net other-than-legal immigration is assumed to be 200,000 persons per year.

Table A1 shows the projected population as of July 1 by broad age group, for the four alternatives. Also shown are tabulated aged dependency ratios (see table footnotes for definitions). Because eligibility for many types of OASDI benefits depends on marital status, the population was projected by marital status, as well as by age and sex. Marriage and divorce rates were based on recent data from the National Center for Health Statistics.

TABLE A1.—SOCIAL SECURITY AREA POPULATION AS OF JULY 1 AND DEPENDENCY RATIOS, BY ALTERNATIVE AND BROAD AGE GROUP, CALENDAR YEARS 1950-2065

Calendar year	Population (in thousands)			Total	Dependency ratio	
	Under 20	20-64	65 and over		Aged ¹	Total ²
Past experience:						
1950	53,895	92,739	12,752	159,386	0.138	0.719
1960	72,989	99,842	17,250	190,081	.173	.904
1970	80,885	113,073	20,892	214,850	.185	.900
1975	78,787	122,639	23,227	224,653	.189	.832
1980	74,927	134,194	26,118	235,239	.195	.753
1985	73,160	144,915	28,975	247,049	.200	.705
Alternative I:						
1990	74,484	152,624	31,907	259,014	.209	.697
1995	77,141	159,675	33,942	270,757	.213	.696
2000	79,239	167,544	34,681	281,464	.207	.680
2005	80,205	176,054	35,528	291,787	.202	.657
2010	81,409	182,984	38,022	302,416	.208	.653
2015	83,748	186,347	43,313	313,408	.232	.682
2020	86,889	187,134	49,959	323,982	.267	.731
2025	89,861	186,430	57,271	333,562	.307	.789
2030	92,206	187,224	62,685	342,114	.335	.827
2035	94,130	191,173	64,633	349,936	.338	.830
2040	96,361	196,595	64,446	357,402	.328	.818
2045	99,088	201,839	63,903	364,831	.317	.808
2050	101,956	206,113	64,465	372,533	.313	.807
2055	104,621	210,391	65,792	380,804	.313	.810
2060	107,082	215,466	67,258	389,806	.312	.809
2065	109,576	221,397	68,491	399,463	.309	.804
Alternatives II-A and II-B:						
1990	74,445	152,571	31,912	258,927	.209	.697
1995	76,431	158,966	34,134	269,531	.215	.696
2000	77,275	166,070	35,276	278,621	.212	.678
2005	76,418	173,872	36,620	286,910	.211	.650
2010	75,179	180,176	39,602	294,958	.220	.637
2015	74,738	182,515	45,376	302,629	.249	.658
2020	75,182	181,702	52,541	309,425	.289	.703
2025	75,594	178,853	60,456	314,903	.338	.761
2030	75,458	176,925	66,547	318,930	.376	.803
2035	74,984	177,507	69,162	321,653	.390	.812
2040	74,637	179,118	69,579	323,334	.388	.805
2045	74,604	180,130	69,531	324,265	.386	.800
2050	74,712	179,624	70,454	324,790	.392	.808
2055	74,708	178,515	72,037	325,259	.404	.822
2060	74,542	177,951	73,416	325,909	.413	.831
2065	74,346	178,219	74,189	326,754	.416	.833
Alternative III:						
1990	74,404	152,524	31,916	258,845	.209	.697
1995	75,681	158,379	34,323	268,383	.217	.695
2000	75,225	164,688	35,838	275,751	.218	.674
2005	72,511	171,416	37,629	281,557	.220	.643
2010	68,855	176,922	41,089	286,866	.232	.621
2015	65,780	178,284	47,385	291,448	.266	.635
2020	63,786	176,015	55,140	294,942	.313	.676
2025	62,010	171,207	63,762	296,979	.372	.735
2030	59,893	166,795	70,669	297,357	.424	.783
2035	57,668	164,281	74,174	296,123	.452	.803
2040	55,537	162,357	75,552	293,446	.465	.807
2045	53,660	159,468	76,452	289,581	.479	.816
2050	52,013	154,646	78,219	284,877	.506	.842
2055	50,423	148,920	80,487	279,730	.541	.880
2060	48,810	143,570	82,071	274,451	.572	.912
2065	47,227	139,395	82,548	269,170	.592	.931

¹Population aged 65 and over, divided by population aged 20-64.

²Sum of population aged 65 and over, and population under age 20, divided by population aged 20-64.

Note: Totals do not necessarily equal the sums of rounded components.

COVERED POPULATION

The number of covered workers in a year is defined as the number of persons who, at any time during the year, have OASDI taxable earnings. Projections of the numbers of covered workers were made by applying projected coverage rates to the projected Social Security area population. The coverage rates—i.e., the number of covered workers in the year, as a percentage of the population as of July 1—were determined by age and sex using projected labor force participation rates and unemployment rates, and their historical relationships to coverage rates. In addition, the coverage rates were adjusted to reflect the increase in coverage of Federal civilian employment that will result from the 1983 Social Security Amendments and the subsequent opportunity offered to Federal civilian employees, who were hired before 1984, to become covered under the OASDI program.

Labor force participation rates were projected by age and sex, taking into account projections of the percentage of the population that is married, the percentage of the population that is disabled, the number of children in the population, the level of retirement benefits, and the state of the economy. All of these factors vary by alternative. For men, the projected age-adjusted labor force participation rates for the year 2065 for alternatives I, II-A, II-B, and III are 1.9, 2.2, 2.5, and 2.8 percentage points lower, respectively, than the 1989 level of 76.9 percent. For women, the projected age-adjusted labor force participation rates increase for all of the alternatives except alternative III. The projected rates for 2065 are 2.8, 1.5, 1.0, and 0.6 percentage points, respectively, different from the 1989 level of 57.4 percent.

The total age-sex-adjusted unemployment rate averaged 5.8 percent for the 30 years 1959-88 and 7.0 percent for the 10 years 1979-88. The ultimate total age-sex-adjusted unemployment rate is assumed to be 5.0, 5.5, 6.0, and 7.0 percent for alternatives I, II-A, II-B, and III, respectively. For alternatives I, II-A, and II-B, the unemployment rate is assumed to change gradually from its 1989 level of 5.3 percent, reaching its ultimate level by 2000. For alternative III, the unemployment rate is assumed to peak in 1991 and again in 1994, because of assumed recessions, and thereafter to decline gradually, reaching its ultimate level by 2000.

The projected age-adjusted coverage rate for men changes from its 1989 level of 75.2 percent to 73.8, 73.4, 72.8, and 72.0 percent in 2065 on the basis of alternatives I, II-A, II-B, and III, respectively. For women, it increases from its 1989 level of 59.0 percent to 61.3, 60.2, 59.3, and 57.8 percent for alternatives I, II-A, II-B, and III, respectively.

AVERAGE EARNINGS AND INFLATION

Future increases in average earnings and in the Consumer Price Index for Urban Wage Earners and Clerical Workers (CPI-W, hereinafter denoted as "CPI") will directly affect the OASDI program. Increases in the CPI directly affect the automatic cost-of-living benefit increases, while inflation in general affects the nominal levels of average earnings, GNP, and taxable payroll. Average earnings in covered employment for each year have a direct effect on the size of the taxable payroll and on

the future level of average benefits. In addition, increases in average wages in the U.S. economy directly affect the indexation, under the automatic-adjustment provisions in the law, of the benefit formulas, the contribution and benefit base, the exempt amounts under the retirement earnings test, the amount of earnings required for a quarter of coverage, and under certain circumstances, the automatic cost-of-living benefit increases.

Increases in average earnings were projected in two components—average earnings of wage-and-salary workers, usually referred to as average wages (and shown in table 10 of this report), and average net earnings of self-employed persons. Each of these was subdivided into increases in real average earnings and increases in the CPI. For simplicity, real-earnings increases are expressed in the form of real-earnings differentials—i.e., the percentage increase in average nominal earnings, minus the percentage increase in the CPI.

The assumed ultimate increases in average real earnings are based on analysis of trends in productivity gains and the factors linking productivity gains with increases in average real earnings. For the 30 years 1959-88, annual increases in productivity for the total U.S. economy averaged 1.6 percent, the result of average annual increases of 2.5, 1.4, and 0.9 percent for the 10-year periods 1959-68, 1969-78 and 1979-88, respectively. Meanwhile, the average annual rate of change in average real earnings was an increase of 0.9 percent for the 30 years 1959-88, the result of average annual increases of 2.6, 1.0, and 0.0 percent, respectively, for the aforementioned 10-year periods. The change in the linkage between annual increases in productivity and real earnings averaged 0.7 percent for the 30 years 1959-88, and 0.0, 1.2, and 0.9 percent, respectively, for the aforementioned 10-year periods. The change in the linkage reflects changes in such factors as the average number of hours worked per year, the extent to which workers share in the value of production, and the proportion of employee compensation paid as wages.

The ultimate annual increases in productivity for all sectors—wage-and-salary workers, self-employed persons, and the total economy—are assumed to be 2.2, 1.9, 1.7, and 1.4 percent for alternatives I, II-A, II-B, and III, respectively. The corresponding ultimate annual rates of change in the linkage for wage-and-salary workers are assumed not to change for alternative I and to be declines of 0.2, 0.4, and 0.6 percent for alternatives II-A, II-B, and III, respectively. This linkage is made up of assumed annual decreases of 0.0, 0.1, 0.2, and 0.3 percent in average hours worked per year, and 0.0, 0.1, 0.2, and 0.3 percent annual declines in wages as a share of compensation, for alternatives I, II-A, II-B, and III, respectively. No ultimate change is assumed for the historically stable ratio of employee compensation to GNP. The resulting ultimate real-wage differentials are 2.2, 1.7, 1.3, and 0.8 percent. Ultimate annual declines in the linkage for self-employed persons are smaller because the proportion of reported compensation that is considered earnings remains constant. As a result, ultimate real-earnings differentials for the self-employed are assumed to be higher than for wage-and-salary workers. The corresponding ultimate real-earnings differentials for wage-and-

salary workers and self-employed persons, combined, are slightly higher than those assumed for wage-and-salary workers only.

For alternative II-A, the CPI is assumed to increase ultimately at an annual rate of 3.0 percent. For alternative II-B, the CPI is assumed to increase ultimately at an annual rate of 4.0 percent, which is somewhat lower than the average annual increase of 4.9 percent experienced between 1959 and 1989. The ultimate increases in the average annual CPI for alternatives I and III of 2.0 percent and 5.0 percent, respectively, were chosen to include a reasonable range of possible values. Ultimate annual increases in the GNP price deflator are assumed to be the same, for each alternative, as for the CPI.

The ultimate increases in average annual wages in covered employment are assumed to be 4.2, 4.7, 5.3, and 5.8 percent, for alternatives I, II-A, II-B, and III, respectively. These were obtained, for each alternative, by adding the assumed annual percentage increase in the CPI to the real-wage differential. Ultimate increases in average wages and earnings for the U.S. economy are very similar to those assumed for average wages in covered employment.

TAXABLE PAYROLL AND TAXES

The taxable payroll for any period is that amount which, when multiplied by the combined employee-employer tax rate, yields the total amount of taxes paid by employees, employers, and the self-employed for work during the period. The taxable payroll is important not just in estimating OASDI income, but also in determining income and cost rates, and actuarial balances. These terms are defined in the introduction to the section entitled "Actuarial Estimates."

In practice, the taxable payroll is calculated as a weighted average of the earnings on which employees, employers, and self-employed persons make contributions to the OASDI program. The weighting takes into account the lower tax rates, as compared to the combined employee-employer rate, which apply to multiple-employer "excess wages," and which did apply, before 1984, to net earnings from self-employment and, before 1988, to tips. For 1983 and later, taxable payroll also includes deemed wage credits for military service. Estimates of taxable earnings for employees, employers, and the self-employed were developed from corresponding estimates of earnings in the U.S. economy, by means of factors which adjust for various differences in these measures. The factors adjust total U.S. earnings by removing earnings from noncovered employment, adding earnings from various outlying areas which are covered by Social Security but are not included in published "U.S." data, and removing earnings above the taxable earnings base.

For the 1990 report, decreases in the ratio of taxable earnings to earnings in OASDI covered employment since 1987, along with the assumption that this ratio will continue to decline slightly over the next decade, result in a reduction in the projected level of taxable payroll.

Estimates of taxes collected were developed from the corresponding estimates of taxable earnings by applying the employee, employer, or self-employed tax rate, and by taking into account the lag time from the incurrence of tax liability to the collection of taxes.

INSURED POPULATION

There are three types of insured status under the OASDI program: fully insured, currently insured, and disability insured. Fully insured status is required of an aged worker for eligibility to a primary retirement benefit and for the eligibility of that worker's spouse and children to auxiliary benefits. Fully insured status is also required of a deceased worker for the eligibility of the worker's survivors to benefits (with the exception of child survivors and parents of eligible child survivors, in which cases the deceased worker is required to have had either currently insured status or fully insured status). Disability insured status, which is more restrictive than fully insured status, is required of a disabled worker for eligibility to a primary disability benefit and for the eligibility of the worker's spouse and children to auxiliary benefits.

Projections of the percentage of the population that is fully insured were made by age and sex, based on the requirement for fully insured status, past and projected coverage rates, and their historical relationships to fully insured rates. Currently insured status was disregarded for purposes of these estimates, because the number of cases in which eligibility for benefits is based solely on currently insured status is relatively small. Projections of the percentage of fully insured persons who are also disability insured were made by age and sex based on past and projected coverage rates, the requirement for disability insured status, and their historical relationships. Finally, the fully insured and disability insured populations were developed from the projected total population by applying the appropriate percentages.

Under this procedure, the percentage of the Social Security area population aged 62 and over that is fully insured is projected to increase from 76.2 on January 1, 1990, to 90.2, 90.0, 89.8, and 89.4 on January 1, 2061, based on alternatives I, II-A, II-B, and III, respectively. The increase for females is projected to be much greater than the increase for males. Based on alternative II-B, for example, the percentage for males is projected to increase only slightly during this period from 92.5 to 93.4, while that for females is projected to increase more substantially from 64.4 to 86.8. The percentage of fully insured persons under the normal retirement age who are disability insured is projected to change only slightly from 86.5 on January 1, 1990, to 85.8, 85.5, 85.3, and 84.8 on January 1, 2061, for alternatives I, II-A, II-B, and III, respectively.

The fully insured population by age and sex was further subdivided by marital status, by using the variation in labor force participation rates by marital status to estimate the variation in coverage rates by marital status. These coverage rates were then used to estimate the variation in the fully insured rates by marital status.

OLD-AGE AND SURVIVORS INSURANCE BENEFICIARIES

The numbers of OASI beneficiaries were projected for each type of benefit separately, by the sex of the worker on whose earnings the benefits are based, and by the age of the beneficiary. For selected types of benefits, the numbers of beneficiaries were also projected by marital status.

In the short-range period, the numbers of retired-worker beneficiaries were developed by applying award rates to the numbers of persons who are insured but not yet retired, and by applying termination rates to the numbers of persons already receiving retired-worker benefits. In the long range, the numbers of retired-worker beneficiaries who are not converted from disabled-worker beneficiaries were projected as a percentage of the aged fully insured population less those persons entitled to disability or widow(er)'s benefits (i.e., the exposed population). The percentages for ages 70 and over are assumed to be 100, because the retirement earnings test and delayed retirement credit do not apply after age 70. For 1990, the retired-worker beneficiaries as a percentage of the exposed population for ages 65 through 69 are assumed to increase, reflecting the change that is effective then in benefit withholding under the retirement earnings test. The percentages for ages 62 through 69 are assumed to change for two reasons. They were adjusted upward through the year 2000, continuing the trend toward earlier retirement. They were further adjusted in the long-range period, for each year of attainment of age 62, as a function of the ratio of the monthly benefit amount payable at each age of entitlement to the amount payable at age-70 entitlement. This resulted in a gradual downward adjustment as the increases in the delayed retirement credit become effective and, beginning in 2000, during the years in which the normal retirement age is scheduled to increase. The net effect of these two adjustments is to increase the percentages at ages 62 through 69 into the 1990s and then to decrease the percentages. Ultimate percentages are assumed to be reached in 2030. The numbers of retired-worker beneficiaries who are converted from disabled-worker beneficiaries were calculated separately in a manner consistent with the calculation of disabled-worker beneficiaries.

The numbers of aged-spouse beneficiaries were estimated from the population projected by age and sex. The benefits of aged-spouse beneficiaries are based on the earnings records of their husbands or wives, who are referred to as "wage earners." In the short-range period, a regression equation was used to project the number of aged-spouse beneficiaries, as a proportion of the aged female or male population not receiving retired-worker or aged-widow(er) benefits. In the long-range period, aged-spouse beneficiaries were estimated from the population projected by age, sex, and marital status. To the numbers of spouses aged 62 and over in the population, a series of factors were applied, representing the probabilities that the spouse and the wage earner meet all of the conditions of eligibility—i.e., the probabilities that (1) the wage earner is 62 or over, (2) the wage earner is insured, (3) the wage earner is receiving benefits, (4) the spouse is not receiving a benefit for the care of an entitled child, (5) the spouse is not insured, (6) the spouse is not eligible to receive a significant government pension based on earnings in noncovered employment, and (7) a residual factor.

In addition, the same factors were applied to the numbers of divorced persons aged 62 and over in the population, with three differences. First, an additional factor is required to reflect the probability that the person's former wage-earner spouse is still alive (otherwise, the person may be entitled to a divorced widow(er)'s benefit). Second, a factor is required

to reflect the probability that the marriage to the wage-earner spouse was at least 10 years in duration. Third, factor (3) was not applied because, effective for January 1985, a divorced person generally need not wait to receive benefits until the former wage-earner spouse is receiving benefits.

The projected numbers of children under age 18, and students aged 18, who are eligible for benefits as children of retired-worker beneficiaries, were based on the projected numbers of children in the population. In the short-range period, a factor was applied, representing the probability that both parents are alive. A regression equation was then used to project the number of children of retired-worker beneficiaries. In the long-range period, entitled children were projected separately by sex of the wage-earner parent. To the numbers of children in the population, factors were applied representing the probabilities that the parent is alive, aged 62 or over, insured, and receiving a retired-worker benefit. Another factor was applied representing the probability that the child is not entitled to a benefit based on the other parent's earnings. For children aged 18, a factor was applied representing the probability that the child is attending a secondary school. The numbers of disabled children aged 18 and over of retired-worker beneficiaries were projected from the adult population in a similar manner, with the inclusion of a factor representing the probability of being disabled since childhood.

In the short-range period, the numbers of young-spouse beneficiaries were projected as a proportion of the projected numbers of child beneficiaries who are either under age 16 or disabled. In the long-range period, young-spouse beneficiaries were projected as a proportion of the projected numbers of child beneficiaries of retired workers, taking into account projected changes in average family size.

The numbers of aged-widow(er) beneficiaries were projected from the population by age and sex. In the short-range period, a regression equation projected the number of aged-widow(er) beneficiaries, as a proportion of the aged female or male population not receiving retired-worker or aged-spouse benefits. In the long-range period, aged-widow(er) beneficiaries were projected from the population by age, sex, and marital status. Four factors were applied to the numbers of widow(er)s in the population aged 60 and over. These factors represent the probabilities that (1) the deceased wage earner was fully insured at death, (2) the widow(er) is not receiving a benefit for the care of an entitled child, (3) the widow(er) is not fully insured, and (4) the widow(er)'s benefits are not withheld because of receipt of a significant government pension based on earnings in noncovered employment. In addition, some insured widow(er)s who had not applied for their retired-worker benefits are assumed to receive widow(er) benefits. Also, the same factors were applied to the numbers of divorced persons aged 60 and over in the population, with additional factors representing the probability that the person's former wage-earner spouse is deceased and that the marriage was at least 10 years in duration.

In the short-range period, the numbers of disabled-widow(er) beneficiaries were estimated as a proportion of the female or male population aged 50-64. In the long-range period, the numbers were projected for

each age 50 through 64 as a percentage of the widowed and divorced populations, adjusted for the insured status of the deceased spouse and the prevalence of disability.

The projected numbers of children under age 18, and students aged 18, who are eligible for benefits as survivors of deceased workers, were based on the projected numbers of children in the population whose mothers or fathers are deceased. In the short-range period, a regression equation was used to project the number of minor-child-survivor beneficiaries as a percentage of such orphaned children. In the long-range period, the numbers of child-survivor beneficiaries were projected in a manner analogous to that for child beneficiaries of retired workers, with the factor representing the probability that the parent is aged 62 or over being replaced by a factor that represented the probability that the parent was deceased.

In the short-range period, the numbers of mother-and-father-survivor beneficiaries were projected from the numbers of child-survivor beneficiaries who are either under age 16 or disabled. In the long-range period, mother-and-father-survivor beneficiaries were estimated from the numbers of child-survivor beneficiaries, taking into account projected changes in average family size.

The numbers of parent-survivor beneficiaries were projected based on the historical pattern of the numbers of such beneficiaries.

Table A2 shows the projected numbers of beneficiaries under the OASI program. Included among the beneficiaries who receive retired-worker benefits are some persons who also receive a residual benefit consisting of the excess of an auxiliary benefit over their retired-worker benefit. Estimates of the numbers of such residual payments were made separately for wives and widows.

TABLE A2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2065
(In thousands)

Calendar year	Retired workers and auxiliaries				Survivors			Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Past experience:								
1945	518	159	13	94	121	377	6	1,288
1950	1,771	508	46	314	169	653	15	3,477
1955	4,474	1,192	122	701	292	1,154	25	7,961
1960	8,061	2,269	268	1,544	401	1,577	36	14,157
1965	11,101	2,614	461	2,371	472	2,074	35	19,128
1970	13,349	2,668	546	3,227	523	2,688	29	23,030
1975	16,588	2,867	643	3,889	582	2,919	21	27,509
1980	19,562	3,016	639	4,411	562	2,610	15	30,814
1985	22,432	3,069	457	4,863	372	1,917	10	33,120
1986	22,987	3,088	450	4,931	350	1,875	9	33,690
1987	23,440	3,090	440	4,984	329	1,836	8	34,126
1988	23,858	3,086	432	5,029	318	1,810	7	34,539
1989	24,327	3,093	423	5,071	312	1,780	6	35,012
Alternative I:								
1990	24,920	3,101	417	5,125	311	1,764	6	35,645
1995	26,284	3,144	460	5,358	313	1,803	4	37,365
2000	27,239	3,076	492	5,485	296	1,879	3	38,470
2005	28,649	2,831	533	5,453	282	1,916	3	39,668
2010	31,918	2,580	593	5,473	267	1,919	3	42,752
2015	37,301	2,564	665	5,549	252	1,932	3	48,266
2020	43,781	2,676	733	5,674	241	1,962	3	55,071
2025	49,505	2,776	782	5,838	242	2,008	3	61,155
2030	53,697	2,768	825	5,908	244	2,052	3	65,498
2035	55,644	2,683	852	5,890	246	2,081	3	67,399
2040	55,763	2,535	863	5,791	248	2,103	3	67,306
2045	55,748	2,463	882	5,678	250	2,131	3	67,154
2050	56,418	2,463	912	5,559	253	2,166	3	67,775

TABLE A2.—OASI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1945-2065 (Cont.)
(In thousands)

Calendar year	Retired workers and auxiliaries			Survivors				Total
	Worker	Wife-husband	Child	Widow-widower	Mother-father	Child	Parent	
Alternative I:								
(Cont.)								
2055	57,644	2,516	948	5,464	258	2,203	3	69,036
2060	58,935	2,569	979	5,432	262	2,236	3	70,416
2065	60,122	2,614	1,002	5,460	265	2,266	3	71,732
Alternative II-A:								
1990	24,926	3,102	417	5,126	311	1,764	6	35,653
1995	26,451	3,160	458	5,387	315	1,812	4	37,586
2000	27,737	3,148	492	5,505	312	1,887	3	39,084
2005	29,526	2,955	532	5,484	297	1,871	3	40,668
2010	33,162	2,742	585	5,510	277	1,786	3	44,063
2015	38,947	2,753	646	5,584	262	1,720	3	49,916
2020	45,877	2,898	697	5,703	256	1,684	3	57,118
2025	52,073	3,035	727	5,870	257	1,672	3	63,637
2030	56,854	3,071	749	5,966	254	1,663	3	68,561
2035	59,385	3,020	758	6,011	249	1,649	3	71,075
2040	60,025	2,896	749	6,000	242	1,626	3	71,542
2045	60,388	2,847	746	5,976	237	1,603	3	71,800
2050	61,319	2,873	754	5,924	233	1,584	3	72,690
2055	62,661	2,951	768	5,846	229	1,565	3	74,023
2060	63,810	3,011	777	5,783	225	1,543	3	75,151
2065	64,561	3,042	778	5,752	220	1,520	3	75,876
Alternative II-B:								
1990	24,926	3,102	417	5,126	311	1,764	6	35,653
1995	26,450	3,160	458	5,387	315	1,812	4	37,586
2000	27,735	3,147	492	5,505	312	1,886	3	39,081
2005	29,521	2,956	532	5,484	296	1,871	3	40,663
2010	33,149	2,747	585	5,510	276	1,785	3	44,055
2015	38,929	2,759	646	5,585	262	1,718	3	49,903
2020	45,849	2,907	697	5,705	256	1,683	3	57,099
2025	52,034	3,049	727	5,872	257	1,670	3	63,611
2030	56,799	3,091	749	5,970	254	1,661	3	68,526
2035	59,312	3,047	757	6,017	248	1,647	3	71,031
2040	59,934	2,929	748	6,008	242	1,624	3	71,489
2045	60,278	2,887	745	5,987	237	1,601	3	71,738
2050	61,189	2,920	752	5,939	233	1,582	3	72,618
2055	62,513	3,005	767	5,865	229	1,562	3	73,943
2060	63,647	3,069	775	5,805	225	1,541	3	75,065
2065	64,388	3,102	776	5,778	220	1,517	3	75,785
Alternative III:								
1990	24,933	3,103	417	5,128	311	1,763	6	35,660
1995	26,614	3,175	457	5,415	313	1,798	4	37,776
2000	28,195	3,217	491	5,515	329	1,889	3	39,639
2005	30,301	3,079	527	5,508	328	1,891	3	41,636
2010	34,259	2,917	569	5,548	297	1,721	3	45,315
2015	40,455	2,965	616	5,629	261	1,536	3	51,465
2020	47,865	3,156	650	5,746	238	1,402	3	59,061
2025	54,583	3,350	660	5,908	229	1,330	3	66,062
2030	60,068	3,455	661	6,004	219	1,286	3	71,697
2035	63,392	3,471	653	6,076	207	1,249	3	75,051
2040	64,877	3,405	627	6,112	194	1,202	3	76,421
2045	66,018	3,410	606	6,136	182	1,154	3	77,508
2050	67,632	3,492	597	6,110	172	1,107	3	79,112
2055	69,464	3,622	595	6,010	162	1,060	3	80,916
2060	70,758	3,706	589	5,882	152	1,012	3	82,104
2065	71,255	3,730	576	5,765	143	965	3	82,438

Note: The numbers of beneficiaries do not include certain uninsured persons, most of whom both attained age 72 before 1968 and have fewer than 3 quarters of coverage, in which cases the costs are reimbursed by the general fund of the Treasury. The number of such uninsured persons was 10,290 as of December 31, 1989, and is estimated to be fewer than 500 by the turn of the century. Totals do not necessarily equal the sums of rounded components.

DISABILITY INSURANCE BENEFICIARIES

The numbers of DI beneficiaries were projected for each type of benefit separately, by the sex of the worker on whose earnings the benefits are based, and the age of the beneficiary. The numbers of disabled-worker beneficiaries were projected from the estimated numbers of such beneficiaries entitled on December 31, 1989, by adding new entitlements and subtracting terminations. The starting numbers of entitled disabled-worker beneficiaries were estimated by age, sex, and

duration of entitlement, from the tabulated number of disabled-worker beneficiaries in current-payment status on December 31, 1987. The numbers of new entitlements during each year were projected by applying assumed disability incidence rates. In the short-range period, an age-adjusted rate was applied to the total age-adjusted disability insured population for each sex. In the long-range period, incidence rates by age and sex were applied to the projected disability insured population (excluding those already entitled to disabled-worker benefits) to obtain new entitlements. The numbers of terminations were projected by applying assumed termination rates to the disabled-worker population. In the short-range period, overall termination rates for each sex were projected based on recent experience and on expected changes in the administration of the DI program. In the long-range period, the numbers of terminations were projected by applying assumed death and recovery rates, by age, sex, and duration of entitlement, to the entitled disabled-worker population, and adding the number of disabled-worker beneficiaries automatically converted to retired-worker beneficiaries at the normal retirement age (currently, age 65).

The disability incidence rates, which declined during 1975-82, increased during 1983-85, and remained steady during 1986-89, are assumed to resume the increasing trend in 1990. In the absence of other factors, the rates would be assumed to increase faster for females than for males during the next decade, reflecting recent experience. However, the addition of male workers afflicted by AIDS becoming disabled-worker beneficiaries makes the projected male and female rates nearly equal. The specific ultimate levels assumed are determined in two stages. First, under an assumption of a constant normal retirement age of 65, the incidence rates are projected to increase through 2010. These levels, for alternatives II-A and II-B, are about 18 percent for males and 20 percent for females higher than the average rates for 1984-86. This produces age-adjusted rates in 2010 of 5.3 per thousand for males and 3.7 per thousand for females, and an age-sex-adjusted rate of 4.6 per thousand. Next, because of the increase in the normal retirement age, further increases are projected in incidence rates at ages over 60. These combined projected increases cause the total gross incidence rate to increase from the current 1988 levels of 4.4 per thousand for males and 3.0 per thousand for females to 7.6 per thousand for males and 5.4 per thousand for females in the year 2026 when the normal retirement age has reached its ultimate level of 67.

For the other alternatives, the disability incidence rates are assumed to follow patterns through time similar to the one for alternatives II-A and II-B. For alternative I, the stage one levels are assumed to be roughly the same as those experienced during the last five years. The 2026 total gross incidence rates are assumed to be 6.5 per thousand for males and 4.4 per thousand for females. For alternative III, the stage one levels are assumed to be higher by about 38 percent for males and 43 percent for females. This level is approximately 80 percent of the rate experienced in 1974, when incidence rates attained their highest level. The 2026 total gross incidence rates are assumed to be 9.0 per thousand for males and 6.5 per thousand for females.

The overall termination rates were projected quarterly in the short-range period. For alternatives II-A and II-B, the rates were projected to increase from the relatively low levels of 1984-89, to levels comparable to the average experienced over the last decade. For alternative III, the termination rates increase more slowly and to lower levels, whereas for alternative I the termination rates increase more quickly and to higher levels.

In the long-range period, the death and recovery rates were projected by age, sex, and duration of entitlement. For all alternatives, the death rates are assumed to decline steadily throughout the 75-year projection period. For alternatives II-A and II-B, they reach levels in 2065 approximately 30 percent lower for males and approximately 20 percent lower for females than those experienced by disabled-worker beneficiaries during 1977-80, the most recent period for which detailed data exist. The recovery rates are assumed to increase from 1989 levels until 1995, when they attain ultimate levels about 15 percent higher than those experienced during the period 1977-80, thereby allowing for the estimated effect of the periodic reviews required by provisions of law first enacted in 1980, and amended in 1983 and 1984.

For alternative I, the death rates in 2065 are assumed to be roughly 20 percent lower for males and approximately 10 percent lower for females than those experienced by disabled-worker beneficiaries during 1977-80, and the recovery rates are assumed to increase to levels 30 percent higher than those of the same period. For alternative III, the death rates in 2065 are assumed to be about 45 percent lower for males and approximately 35 percent lower for females than those experienced during 1977-80, and recovery rates are assumed to be equal to those experienced during 1977-80.

In the short-range period, the projected numbers of children under age 18, students aged 18, and disabled children aged 18 and over, who are eligible for benefits as children of disabled-worker beneficiaries, were projected by applying quarterly award and termination rates. Awards to the three categories of child beneficiaries were based on the numbers of awards to disabled-worker beneficiaries.

In the long-range period, the projected numbers of minor child and student beneficiaries were based on the projected numbers of children in the population by age. To these numbers of children were applied factors representing the probability that either of their parents is insured and disabled. The numbers of disabled children aged 18 and over were projected as a function of the numbers of disabled-worker beneficiaries and the size of the adult population.

In the short-range period, the numbers of young-spouse beneficiaries were projected by applying quarterly award and termination rates, where awards were based on the numbers of awards to child beneficiaries who are either under age 16 or disabled. The numbers of aged-spouse beneficiaries were also projected by applying quarterly award and termination rates, where awards were based on the number of awards to disabled-worker beneficiaries.

In the long-range period, the numbers of young-spouse beneficiaries were projected as a proportion of the projected numbers of child

beneficiaries who are either under age 16 or disabled, taking into account projected changes in family size. The numbers of aged-spouse beneficiaries were projected as a proportion of the numbers of disabled-worker beneficiaries, based on recent experience and allowing for projected changes in marriage rates.

Table A3 shows the projected numbers of beneficiaries under the DI program.

TABLE A3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2065
(In thousands)

Calendar year	Disabled workers	Auxiliaries		Total
		Wife-husband	Child	
Past experience:				
1960	455	77	155	687
1965	988	193	558	1,739
1970	1,493	283	889	2,665
1975	2,489	453	1,411	4,352
1980	2,859	462	1,358	4,678
1985	2,656	306	945	3,907
1986	2,727	301	965	3,993
1987	2,786	291	968	4,045
1988	2,830	281	963	4,074
1989	2,895	271	962	4,129
Alternative I:				
1990	2,933	261	958	4,152
1995	3,047	231	943	4,221
2000	3,542	267	1,045	4,854
2005	4,184	277	1,103	5,565
2010	4,830	286	1,124	6,240
2015	5,176	278	1,139	6,593
2020	5,331	277	1,169	6,776
2025	5,627	300	1,220	7,147
2030	5,530	286	1,264	7,080
2035	5,474	280	1,294	7,048
2040	5,556	275	1,322	7,154
2045	5,824	290	1,358	7,472
2050	6,003	300	1,401	7,705
2055	6,124	310	1,448	7,882
2060	6,220	315	1,492	8,026
2065	6,392	321	1,533	8,247
Alternative II-A:				
1990	2,956	263	965	4,183
1995	3,281	252	1,015	4,548
2000	3,924	308	1,164	5,395
2005	4,758	337	1,248	6,344
2010	5,591	366	1,262	7,219
2015	6,060	374	1,258	7,691
2020	6,271	388	1,260	7,919
2025	6,621	424	1,283	8,328
2030	6,497	411	1,302	8,210
2035	6,414	404	1,310	8,127
2040	6,485	396	1,310	8,191
2045	6,755	413	1,313	8,480
2050	6,882	423	1,319	8,624
2055	6,889	428	1,329	8,647
2060	6,816	424	1,337	8,576
2065	6,830	423	1,342	8,595
Alternative II-B:				
1990	2,956	263	965	4,183
1995	3,281	252	1,014	4,547
2000	3,922	308	1,163	5,393
2005	4,754	337	1,247	6,338
2010	5,583	366	1,260	7,208
2015	6,047	374	1,254	7,675
2020	6,255	388	1,256	7,899
2025	6,601	424	1,279	8,304
2030	6,474	412	1,297	8,183
2035	6,390	404	1,305	8,099
2040	6,459	397	1,305	8,161
2045	6,727	414	1,308	8,449
2050	6,854	424	1,314	8,592
2055	6,860	430	1,324	8,615
2060	6,787	426	1,331	8,544
2065	6,801	425	1,337	8,562

TABLE A3.—DI BENEFICIARIES WITH MONTHLY BENEFITS IN CURRENT-PAYMENT STATUS AS OF DECEMBER 31 BY ALTERNATIVE, CALENDAR YEARS 1960-2065 (Cont.)
[In thousands]

Calendar year	Disabled workers	Auxiliaries		Total
		Wife-husband	Child	
Alternative III:				
1990	2,977	265	970	4,212
1995	3,538	276	1,094	4,908
2000	4,420	364	1,313	6,098
2005	5,505	422	1,429	7,356
2010	6,568	476	1,424	8,468
2015	7,178	500	1,381	9,060
2020	7,448	525	1,341	9,314
2025	7,858	570	1,324	9,753
2030	7,699	553	1,309	9,561
2035	7,595	538	1,291	9,424
2040	7,660	523	1,259	9,443
2045	7,930	538	1,225	9,693
2050	7,971	543	1,194	9,708
2055	7,800	538	1,167	9,505
2060	7,474	514	1,139	9,128
2065	7,260	498	1,112	8,870

Note: Totals do not necessarily equal the sums of rounded components.

AVERAGE BENEFITS

Average benefits were projected by type of benefit based on recent historical averages, projected average Primary Insurance Amounts (PIAs), and projected ratios of average benefits to average PIAs. Average PIAs were calculated from projected distributions of beneficiaries by duration from year of award, average awarded PIAs, and increases thereto since the year of award, because of automatic benefit increases, recomputations to reflect additional covered earnings, and other factors. Average awarded PIAs were calculated from projected earnings histories, which were developed from the actual earnings histories associated with a sample of awards made in 1983.

For several types of benefits—retired-worker, aged-spouse, and aged-widow(er) benefits—the percentage of the PIA that is payable depends on the age at initial entitlement to benefits. Projected ratios of average benefits to average PIAs for these types of benefits were based on projections of age distributions at initial entitlement.

BENEFIT PAYMENTS

For each type of benefit, benefit payments were calculated as the product of a number of beneficiaries and a corresponding average monthly benefit. In the short-range period, benefit payments were calculated on a quarterly basis. In the long-range period, all benefit payments were calculated on an annual basis, using the number of beneficiaries on December 31. These amounts were adjusted to include retroactive payments to newly awarded beneficiaries, and other amounts not reflected in the regular monthly benefit payments.

Lump-sum death payments were calculated as the product of (1) the number of such payments, which was projected on the basis of the assumed death rates, the projected fully insured population, and the estimated percentage of the fully insured population that would qualify for benefits, and (2) the amount of the lump-sum death payment, which is \$255.

ADMINISTRATIVE EXPENSES

The projection of administrative expenses through 1998 was based on assumed increases in average wages, increases in the CPI, and increases in the number of beneficiaries. For years after 1998, administrative expenses are assumed to increase with the numbers of beneficiaries and with average earnings in covered employment, taking into account assumed increases in productivity.

RAILROAD RETIREMENT FINANCIAL INTERCHANGE

The effect of the financial interchange with the Railroad Retirement program was evaluated on the basis of trends similar to those used in estimating the cost of OASDI benefits. The resulting effect was annual short-range costs of about \$3-4 billion and an average annual long-range cost of 0.03 percent of taxable payroll to the OASDI program.

BENEFITS TO UNINSURED PERSONS

The law provides for special monthly cash payments to certain uninsured persons who attained age 72 before 1968 or who have 3 quarters of coverage for each year after 1966 and before the year of attainment of age 72. The numbers of such uninsured persons were projected based on an extrapolation of the historical survival rate of the members of that group. The benefit payable to these uninsured persons is a fixed amount which increases by the percentage benefit increase applicable to regular OASDI benefits. These payments are made from the OASI Trust Fund, which is then reimbursed from the general fund of the Treasury for the costs (including administrative expenses and interest) associated with providing payments to those persons with fewer than 3 quarters of coverage. The nonreimbursable payments are assumed to be insignificant after 1998. Neither the reimbursable payments nor the associated reimbursements are reflected in the cost rates or the income rates. These amounts are reflected, however, in tables which show trust fund operations.

MILITARY-SERVICE TRANSFERS

As a result of the 1983 amendments, the OASI and DI Trust Funds received lump-sum payments, in May 1983, for the cost (including administrative expenses) of providing additional benefit payments resulting from noncontributory wage credits for military service performed prior to 1957. Adjustments to the payments were made in 1985, and additional adjustments will be made in 1990 and every fifth year thereafter. The adjustments for 1990 were estimated based on the change in interest rates since the determination of the adjustments in 1985. No adjustments after 1990 would be due unless actual interest rates are different from those assumed, or changes are made in the methods used to determine the military-service transfers.

INCOME FROM TAXATION OF BENEFITS

The OASI and DI Trust Funds are credited with the additional income taxes attributable to the partial taxation of OASDI benefit payments. For the short-range period, income to the trust funds from such taxation was estimated by applying the following two factors to total OASI and DI benefit payments: (1) the percentage of benefit payments that is taxable, and (2) the average tax rate applicable to those benefits. For the long-range period, income to the trust funds from such taxation was projected by applying factors representing the ratio of such income to total OASDI benefit payments under varying levels of income thresholds. Because the thresholds are constant in the law, their values in relation to future income and benefit levels decline. These factors were projected based on the results of a model developed by the Office of Tax Analysis, Department of the Treasury, relating OASDI benefit payments to total personal income for a sample of recent tax returns.

APPENDIX B.—SENSITIVITY ANALYSIS

This appendix presents estimates which illustrate the sensitivity of the long-range estimates to changes in selected individual assumptions. The estimates based on the four alternative sets of assumptions (see section VI.E) illustrate variations that result from different combinations of assumptions. In the sensitivity analysis presented in this appendix, alternative II-B is used as the reference point, and one assumption at a time within that alternative is varied. Similar variations in the selected assumptions within the other alternatives would result in similar relative variations in the long-range estimates.

Each table which follows shows the effects of changing the particular assumption under consideration on the OASDI income rates, cost rates, and actuarial balances. Because the income rate varies only slightly with changes in assumptions, it is not considered in the discussion of the tables. The change in each of the actuarial balances is approximately equal to the change in the corresponding cost rate, but in the opposite direction.

TOTAL FERTILITY RATE

Table B1 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the ultimate total fertility rate. These assumptions are that the ultimate total fertility rate will be 1.6 children per woman (as assumed for alternative III), 1.9 (as assumed for alternatives II-A and II-B), and 2.2 (as assumed for alternative I). The rate is assumed to change gradually from its current level and to reach the various ultimate values in 2014.

**TABLE B1.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES,
BASED ON ALTERNATIVE II-B WITH VARIOUS FERTILITY ASSUMPTIONS**
(As a percentage of taxable payroll)

Calendar years	Ultimate total fertility rate ¹		
	1.6	1.9	2.2
Income rate:			
25-year: 1990-2014	12.99	12.99	12.99
50-year: 1990-2039	13.01	13.01	13.00
75-year: 1990-2064	13.07	13.04	13.02
Average cost rate:			
25-year: 1990-2014	10.80	10.83	10.85
50-year: 1990-2039	12.96	12.83	12.72
75-year: 1990-2064	14.49	13.95	13.44
Balance:			
25-year: 1990-2014	+ 2.19	+ 2.17	+ 2.14
50-year: 1990-2039	+ .06	+ .17	+ .28
75-year: 1990-2064	-1.42	-.91	-.43

¹The total fertility rate for any year is the average number of children who would be born to a woman in her lifetime if she were to experience the birthrates by age observed in, or assumed for, the selected year, and if she were to survive the entire child-bearing period. The ultimate total fertility rate is assumed to be reached in 2014.

For the 25-year period, the cost rate for the three fertility assumptions varies by only 0.05 percent of taxable payroll. In contrast, the 75-year cost rate varies over a wide range, decreasing from 14.49 to 13.44 percent, as the assumed ultimate total fertility rate increases from 1.6 to 2.2. Similarly, while the 25-year actuarial balance varies by only 0.05 percent of taxable payroll, the 75-year actuarial balance varies over a much wider range—from -1.42 to -0.43 percent.

During the 25-year period, changes in fertility affect the working population only slightly and result in relatively minor changes in the number of child beneficiaries. Hence, the program cost is affected only slightly. For the 75-year long-range period, however, changes in fertility have a relatively greater impact on the labor force than on the beneficiary population. As a result, an increase in fertility significantly reduces the cost rate. Each increase of 0.1 in the ultimate total fertility rate increases the long-range actuarial balance by about 0.16 percent of taxable payroll.

DEATH RATES

Table B2 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about future reductions in death rates. The analysis was developed by varying the percentage decrease assumed to occur during 1990-2064 in the age-sex-adjusted death rate. The decreases assumed for this period are about 18 percent (as assumed for alternative I), 35 percent (as assumed for alternatives II-A and II-B), and 50 percent (as assumed for alternative III).

TABLE B2.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DEATH-RATE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Reduction in death rates ¹		
	18 percent	35 percent	50 percent
Income rate:			
25-year: 1990-2014	12.99	12.99	13.00
50-year: 1990-2039	12.99	13.01	13.03
75-year: 1990-2064	13.01	13.04	13.08
Average cost rate:			
25-year: 1990-2014	10.66	10.83	11.00
50-year: 1990-2039	12.40	12.83	13.29
75-year: 1990-2064	13.26	13.95	14.78
Balance:			
25-year: 1990-2014	+ 2.32	+ 2.17	+ 2.00
50-year: 1990-2039	+ .58	+ .17	-.27
75-year: 1990-2064	-.25	-.91	-1.70

¹The measure of the reduction in death rates is the decrease in the age-sex-adjusted death rate during 1990-2064.

The variation in cost for the 25-year period is less pronounced than the variation for the 75-year period because the decreases in death rates are assumed to occur gradually and because of the specific changes in the age composition of the population that are projected to occur. The 25-year cost rate increases from 10.66 percent (for 18-percent lower ultimate death rates) to 11.00 percent (for 50-percent lower ultimate rates). The long-range cost rate increases from 13.26 to 14.78 percent. The actuarial balance decreases from + 2.32 to + 2.00 percent for the 25-year period, and from -0.25 to -1.70 percent for the 75-year period.

Lower death rates cause both the income (as well as taxable payroll) and the outgo of the OASDI program to be higher than they would otherwise be. The relative increase in outgo, however, exceeds the relative increase in taxable payroll. For any given year, reductions in the death rates for people who have attained the normal retirement age (people whose death rates are the highest) increase the number of retired-worker beneficiaries (and, therefore, the amount of retirement benefits paid) without adding significantly to the number of covered

workers (and, therefore, to the taxable payroll). Although reductions for people aged 50 to normal retirement age do result in significant increases to the taxable payroll, those increases are not large enough to offset the sum of the additional retirement benefits mentioned above and the disability benefits paid to additional beneficiaries in this pre-retirement age group. At ages under 50, death rates are so low that even substantial reductions would not result in significant increases in the numbers of covered workers or beneficiaries. Consequently, if death rates for all ages are lowered by about the same relative amount, outgo increases at a rate greater than the rate of growth in payroll, thereby resulting in higher cost rates. Each additional 10-percentage-point reduction in the age-sex-adjusted death rate assumed to occur in 1990-2064, relative to the 35-percent reduction assumed for alternative II-B, decreases the long-range actuarial balance by about 0.40 percent of taxable payroll.

NET IMMIGRATION

Table B3 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the magnitude of net immigration. These assumptions are that the annual net immigration will be 450,000 persons (as assumed for alternative III), 600,000 persons (as assumed for alternatives II-A and II-B), and 750,000 persons (as assumed for alternative I).

TABLE B3.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS NET-IMMIGRATION ASSUMPTIONS
[As a percentage of taxable payroll]

Calendar years	Net immigration per year		
	450,000	600,000	750,000
Income rate:			
25-year: 1990-2014	13.00	12.99	12.99
50-year: 1990-2039	13.01	13.01	13.00
75-year: 1990-2064	13.05	13.04	13.04
Average cost rate:			
25-year: 1990-2014	10.87	10.83	10.78
50-year: 1990-2039	12.92	12.83	12.75
75-year: 1990-2064	14.05	13.95	13.86
Balance:			
25-year: 1990-2014	+ 2.13	+ 2.17	+ 2.21
50-year: 1990-2039	+ .09	+ .17	+ .25
75-year: 1990-2064	-1.01	-.91	-.82

For all three periods, the cost rate decreases with increasing rates of net immigration. For the 25-year period, the cost rate decreases from 10.87 percent of taxable payroll (for annual net immigration of 450,000 persons) to 10.78 percent (for annual net immigration of 750,000 persons). For the 50-year period, it decreases from 12.92 percent to 12.75 percent, and for the 75-year period, it decreases from 14.05 percent to 13.86 percent. The actuarial balance increases from + 2.13 to + 2.21 percent for the 25-year period, from + 0.09 to + 0.25 for the 50-year period, and from -1.01 to -0.82 percent for the 75-year period.

The cost rate decreases with increasing rates of net immigration because immigration occurs at relatively young ages, thereby increasing the numbers of covered workers earlier than the numbers of beneficiaries. Each additional group of 100,000 immigrants relative to the 600,000 net immigration assumed for alternative II-B, increases the long-range actuarial balance by about 0.06 percent of taxable payroll.

REAL-WAGE DIFFERENTIAL

Table B4 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the real-wage differential. These assumptions are that the ultimate real-wage differential will be 0.8 percentage point (as assumed for alternative III), 1.3 percentage points (as assumed for alternative II-B), 1.7 percentage points (as assumed for alternative II-A), and 2.2 percentage points (as assumed for alternative I). In each case, the ultimate annual increase in the CPI is assumed to be 4.0 percent (as assumed for alternative II-B), yielding ultimate percentage increases in average annual wages in covered employment of 4.8, 5.3, 5.7, and 6.2 percent, respectively.

TABLE B4.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS REAL-WAGE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Ultimate percentage increase in wages-CPI ¹			
	4.8-4.0	5.3-4.0	5.7-4.0	6.2-4.0
Income rate:				
25-year: 1990-2014	13.02	12.99	12.97	12.95
50-year: 1990-2039	13.04	13.01	12.98	12.95
75-year: 1990-2064	13.08	13.04	13.01	12.98
Average cost rate:				
25-year: 1990-2014	11.18	10.83	10.55	10.20
50-year: 1990-2039	13.34	12.83	12.44	11.94
75-year: 1990-2064	14.51	13.95	13.51	12.95
Balance:				
25-year: 1990-2014	+ 1.83	+ 2.17	+ 2.43	+ 2.75
50-year: 1990-2039	- .30	+ .17	+ .54	+ 1.00
75-year: 1990-2064	-1.43	- .91	- .49	+ .03

¹The first value in each pair is the assumed ultimate annual percentage increase in average wages in covered employment. The second value is the assumed ultimate annual percentage increase in the Consumer Price Index. The difference between the two values is the real-wage differential.

For the 25-year period, the cost rate decreases from 11.18 percent (for a real-wage differential of 0.8 percentage point) to 10.20 percent (for a differential of 2.2 percentage points). For the 50-year period, it decreases from 13.34 to 11.94 percent, and for the 75-year period it decreases from 14.51 to 12.95 percent. The actuarial balance increases from + 1.83 to + 2.75 percent for the 25-year period, from -0.30 to + 1.00 for the 50-year period, and from -1.43 to + 0.03 percent for the 75-year period.

The cost rate decreases with increasing real-wage differentials, because the higher real-wage levels increase the taxable payroll, while benefit increases are not affected. Although the initial benefit levels are higher because of the higher wages, these increases are more than offset by the increases in the taxable payroll of future workers. Each 0.5-percentage-point increase in the assumed real-wage differential increases the long-range actuarial balance by about 0.52 percent of taxable payroll.

CONSUMER PRICE INDEX

Table B5 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the rate of increase for the Consumer Price Index (CPI). These assumptions are that the ultimate annual increase in the CPI will be 2.0 percent (as assumed for alternative I), 3.0 percent (as assumed for alternative II-A), 4.0 percent (as assumed for alternative II-B), 5.0 percent (as assumed for alternative III), and 6.0 percent. In

each case, the ultimate real-wage differential is assumed to be 1.3 percentage points (as assumed for alternative II-B), yielding ultimate percentage increases in average annual wages in covered employment of 3.3, 4.3, 5.3, 6.3, and 7.3 percent, respectively.

TABLE B5.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS CPI-INCREASE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Ultimate percentage increases in wages-CPI ¹				
	3.3-2.0	4.3-3.0	5.3-4.0	6.3-5.0	7.3-6.0
Income rate:					
25-year: 1990-2014.....	13.00	13.00	12.99	12.99	12.99
50-year: 1990-2039.....	13.02	13.01	13.01	13.00	12.99
75-year: 1990-2064.....	13.06	13.05	13.04	13.03	13.02
Average cost rate:					
25-year: 1990-2014.....	11.06	10.94	10.83	10.71	10.60
50-year: 1990-2039.....	13.21	13.02	12.83	12.65	12.48
75-year: 1990-2064.....	14.40	14.17	13.95	13.74	13.54
Balance:					
25-year: 1990-2014.....	+ 1.94	+ 2.05	+ 2.17	+ 2.28	+ 2.39
50-year: 1990-2039.....	-0.19	-0.01	+ .17	+ .35	+ .52
75-year: 1990-2064.....	-1.33	-1.12	-0.91	-0.71	-0.51

¹The first value in each pair is the assumed ultimate annual percentage increase in average wages in covered employment. The second value is the assumed ultimate annual percentage increase in the Consumer Price Index.

For all three periods, the cost rate decreases with greater assumed rates of increase in the CPI. For the 25-year period, the cost rate decreases from 11.06 (for CPI increases of 2.0 percent) to 10.60 percent (for CPI increases of 6.0 percent). For the 50-year period, it decreases from 13.21 to 12.48 percent, and for the 75-year period, it decreases from 14.40 to 13.54 percent. The actuarial balance increases from + 1.94 to + 2.39 percent for the 25-year period, from -0.19 to + 0.52 for the 50-year period, and from -1.33 to -0.51 percent for the 75-year period.

The patterns described above result primarily from the time lag between the effects of the CPI changes on taxable payroll and on benefit payments. When assuming a greater rate of increase in the CPI (in conjunction with a constant real-wage differential), the effect on taxable payroll of the implied greater rate of increase in average wages is experienced immediately, while the effect on benefits of the greater rate of increase in the CPI is experienced with a lag of about 1 year. In addition, the effect on benefits of the greater rate of increase in average wages is experienced no sooner than 2 years later. Thus, the higher taxable payrolls have a stronger effect than the higher benefits, thereby resulting in lower cost rates. The effect of each 1.0-percentage-point increase in the rate of change assumed for the CPI is an increase in the long-range actuarial balance of about 0.20 percent of taxable payroll.

REAL-INTEREST RATE

Table B6 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about the annual real-interest rate for special public-debt obligations issuable to the trust funds. These assumptions are that the ultimate annual real-interest rate will be 1.0 percent, 1.5 percent (as assumed for alternative III), 2.0 percent (as assumed for alternative II-B), 2.5 percent (as assumed for alternative II-A), and 3.0 percent (as assumed for alternative I). In each case, the ultimate annual increase in the CPI is assumed to be 4.0 percent (as assumed for alternative II-B), resulting in ultimate annual yields of 5.0, 5.6, 6.1, 6.6, and 7.1 percent, respectively.

TABLE B6.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS REAL-INTEREST ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Ultimate annual real-interest rate				
	1.0 percent	1.5 percent	2.0 percent	2.5 percent	3.0 percent
Income rate:					
25-year: 1990-2014.....	12.97	12.98	12.99	13.00	13.01
50-year: 1990-2039.....	13.00	13.00	13.01	13.01	13.02
75-year: 1990-2064.....	13.05	13.04	13.04	13.04	13.04
Average cost rate:					
25-year: 1990-2014.....	10.84	10.83	10.83	10.82	10.82
50-year: 1990-2039.....	13.15	12.99	12.83	12.68	12.54
75-year: 1990-2064.....	14.48	14.22	13.95	13.69	13.44
Balance:					
25-year: 1990-2014.....	+ 2.13	+ 2.15	+ 2.17	+ 2.18	+ 2.20
50-year: 1990-2039.....	-.15	+ .01	+ .17	+ .33	+ .48
75-year: 1990-2064.....	-1.44	-1.18	-.91	-.65	-.40

For the 25-year period, the cost rate decreases slightly with increasing real-interest rates from 10.84 percent (for an ultimate real-interest rate of 1.0 percent) to 10.82 percent (for an ultimate real-interest rate of 3.0 percent). For the 50-year period, it decreases from 13.15 to 12.54 percent, and for the 75-year period, it decreases from 14.48 to 13.44 percent. The actuarial balance increases from + 2.13 to + 2.20 percent for the 25-year period, from -0.15 to + 0.48 percent for the 50-year period, and from -1.44 to -0.40 percent for the 75-year period. Each 0.5-percentage-point increase in the assumed real-interest rate increases the long-range actuarial balance by about 0.26 percent of taxable payroll.

DISABILITY INCIDENCE RATES

Table B7 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions concerning future disability incidence rates. These assumptions provide that the total gross annual incidence rates will increase gradually from the 1988 levels of 4.4 per thousand for males and 3.0 per thousand for females to levels, in 2026, of 6.5 per thousand for males and 4.4 per thousand for females (as assumed in alternative I), 7.6 per thousand for males and 5.4 per thousand for females (as assumed in alternatives II-A and II-B), and 9.0 per thousand for males and 6.5 per thousand for females (as assumed in alternative III).

TABLE B7.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DISABILITY INCIDENCE ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Disability incidence rates based on alternative—		
	I	II-A and II-B	III
Income rate:			
25-year: 1990-2014.....	12.99	12.99	13.00
50-year: 1990-2039.....	13.00	13.01	13.01
75-year: 1990-2064.....	13.04	13.04	13.05
Average cost rate:			
25-year: 1990-2014.....	10.72	10.83	10.95
50-year: 1990-2039.....	12.67	12.83	13.02
75-year: 1990-2064.....	13.77	13.95	14.17
Balance:			
25-year: 1990-2014.....	+ 2.27	+ 2.17	+ 2.04
50-year: 1990-2039.....	+ .33	+ .17	-.01
75-year: 1990-2064.....	-.73	-.91	-1.12

For the 25-year period, the cost rate increases with increasing disability incidence rates from 10.72 percent (for the relatively low rates assumed for alternative I) to 10.95 percent (for the relatively high rates assumed for alternative III). For the 50-year period, it increases from 12.67 to 13.02 percent, and for the 75-year period, it increases from 13.77 to 14.17 percent. The actuarial balance decreases from + 2.27 to + 2.04 percent for the 25-year period, from + 0.33 to -0.01 percent for the 50-year period, and from -0.73 to -1.12 percent for the 75-year period.

DISABILITY TERMINATION RATES

Table B8 shows the estimated OASDI income rates, cost rates, and actuarial balances, on the basis of alternative II-B with various assumptions about future disability termination rates.

For all four alternatives, death-termination rates by age and sex are assumed to decline throughout the 75-year period. At the end of that period, they reach levels that, in comparison to the corresponding annual rates experienced during the base period, 1977-80, are lower by about 20 percent for males and 10 percent for females for alternative I, lower by about 30 percent for males and 20 percent for females for alternatives II-A and II-B, and lower by about 45 percent for males and 35 percent for females for alternative III.

For all four alternatives, ultimate recovery-termination rates by age and sex are assumed to be attained in 1995. For alternative I, they are about 30 percent higher than the corresponding rates experienced during the base period. For alternative III, they are about the same as the base-period rates. For alternatives II-A and II-B, such rates are about 15 percent higher than those experienced in the base period, in order to reflect the effects of the additional periodic reviews that began in 1981.

TABLE B8.—ESTIMATED OASDI INCOME RATES, COST RATES, AND ACTUARIAL BALANCES, BASED ON ALTERNATIVE II-B WITH VARIOUS DISABILITY TERMINATION ASSUMPTIONS
(As a percentage of taxable payroll)

Calendar years	Disability termination rates based on alternative—		
	I	II-A and II-B	III
Income rate:			
25-year: 1990-2014.....	12.99	12.99	12.99
50-year: 1990-2039.....	13.01	13.01	13.01
75-year: 1990-2064.....	13.04	13.04	13.04
Average cost rate:			
25-year: 1990-2014.....	10.80	10.83	10.86
50-year: 1990-2039.....	12.80	12.83	12.89
75-year: 1990-2064.....	13.91	13.95	14.02
Balance:			
25-year: 1990-2014.....	+ 2.19	+ 2.17	+ 2.13
50-year: 1990-2039.....	+ .21	+ .17	+ .12
75-year: 1990-2064.....	-.87	-.91	-.98

For the 25-year period, the cost rate increases with decreasing disability termination rates from 10.80 percent (for the relatively high rates assumed for alternative I) to 10.86 percent (for the relatively low rates assumed for alternative III). For the 50-year period, it increases from 12.80 to 12.89 percent, and for the 75-year period, it increases from 13.91 to 14.02 percent. The actuarial balance decreases from + 2.19 to + 2.13 percent for the 25-year period, from + 0.21 to + 0.12 percent for the 50-year period, and from -0.87 to -0.98 percent for the 75-year period.